Juvenile Salmon Usage of Nearshore Habitats along City of Seattle Marine Shorelines

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Abstract

Shoreline modifications have altered many of the natural habitats in nearshore areas of Puget Sound. The effects of retaining structures on ecological processes are particularly unknown, especially in regards to usage by outmigrating juvenile salmonids. The main goal of our study was to quantify the abundance and behavior of juvenile salmonids and other fishes along various habitat types of Seattle's marine shorelines, as funded by the Seattle Public Utilities Department. We utilized enclosure nets and snorkel surveys to sample fishes directly along shore at five main habitat types: cobble beach, sand beach, rip-rap, deep rip-rap, and overwater structures.

Results reported herein are preliminary, pending completion of the final report by March 30, 2004. Minimal differences were found in fish densities between cobble beaches, sand beaches, and rip-rap that only extended into the upper intertidal. Significant density differences occurred only in bottom-dwelling fishes, generally higher abundances of juvenile flatfish at sand beaches, crabs at cobble beaches, and sculpins at rip-rap. This suggests that substrate type and slope may be most important when any shoreline modifications occur only in the upper intertidal.

Shoreline modifications have the greatest effect on nearshore fish communities when the alterations extend from the supratidal through the subtidal zone. Deep rip-rap and overwater structures truncate the shallow water zone, creating deep water directly at the shoreline. Higher densities of total fish and juvenile salmonids are often found at these modified shorelines. Therefore, it appears that when juvenile salmonids are migrating

along the shoreline and encounter a modified habitat with the shallow water zone truncated, they may be forced to inhabit deeper water and also school more. Juvenile salmonids avoid swimming underneath overwater structures, whereas surfperches, crabs, and sculpins are associated with being underneath or at the pilings. Deep rip-rap had higher densities of surfperches and gunnels, fishes which prefer a complex structural habitat with interstitial spaces. Other behavior and specific location observations from snorkel surveys support trends from density measurements.

Prey input from either marine benthic/epibenthic or terrestrial riparian resources were the two major contributors to juvenile chinook diets. Riparian insects in chinook guts were lowest at sites with retaining structures at either the intertidal or supratidal zone, signifying limited access to terrestrial prey resources.

Overall, our results indicate that shoreline modifications have the most dramatic effect on fish densities and behaviors when the alterations extend from the supratidal through the subtidal zone. Differences are often more dependent on consequences of shoreline modifications, such as changes in water depth, substrate, and shoreline vegetation. Future research should continue to examine the effects of shoreline modifications on ecological communities in regard to bank type, tidal height, and salinity regimes.